



**U.S. Army Research Institute
for the Behavioral and Social Sciences**

Research Report 1781

**The Commanders' Integrated Training Tool for the
Close Combat Tactical Trainer
3: Final Prototype Development**

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**U.S. Army Research Institute
for the Behavioral and Social Sciences**

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FOREWORD

The use of simulations in U.S. Army training continues to increase, as does the need for tools and techniques for exploiting simulation training capabilities. For the past several years the U.S. Army Research Institute for the Behavioral and Social Sciences has been a leader in the development of structured training approaches providing such tools and techniques, primarily through work accomplished in the Armored Forces Research Unit (AFRU) at Fort Knox, Kentucky. Experience with structured simulation-based training has led to the recognition of a need to provide a comprehensive system to "train the trainer." The Close Combat Tactical Trainer (CCTT) magnifies this need since an experienced full-time training team is not provided to conduct training. Commanders and other trainers need to understand the capabilities of the CCTT, and to be able to tailor structured training to maximize the benefit of the CCTT in their unit training strategy.

This report describes the final prototype development of a computer software package that helps commanders and other unit trainers to develop and manage structured training in the CCTT. This effort was entitled "Commanders' Integrated Training Tool - 3 (CITT-3)," building upon two earlier AFRU projects which led to development of CITT 2.0. The AFRU accomplished the CITT-3 effort as part of Work Package 205, "Assessment of Force XXI Training Tools and Techniques." The relevant requirements document is a Memorandum for Record between the Chief, AFRU and the Project Manager for the Combined Arms Tactical Trainer (PM CATT), entitled "Structured Training for the Close Combat Tactical Trainer," dated July 25, 1997.

The CITT-3 project and the resulting CITT 2.1 software package were briefed to representatives of the U.S. Army Training Support Center, the PM CATT, and the U.S. Army Training and Doctrine Command System Manager for CATT on September 12, 2001. The software package was formally transferred to the PM CATT for continued implementation as part of the baseline CCTT system on the same date. The CITT 2.1 software package is available in stand-alone and Web-based versions and has been provided to CCTT sites and other selected locations. This report documents the methods and lessons learned in the third round of CITT development and refinement as a fully-fieldable system. It will be useful to individuals and agencies involved in the production and implementation of Army training development and management systems for live, virtual, or constructive training environments.

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Technical Director

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The authors wish to acknowledge the contributions and assistance of a number of individuals and organizations without whom the project could not have been accomplished. Dr. Bill Burnside, contracting officer's representative (COR); Dr. Dave Bessemer, assistant COR, and Major (MAJ) William Rademacher, Research and Development Coordinator, from the Armored Forces Research Unit, U.S. Army Research Institute for the Behavioral and Social Sciences, were active contributors to the project providing assistance and counsel throughout. Mr. Bob White, the project sponsor at Project Manager for the Combined Arms Tactical Trainer (PM CATT), provided valuable assistance and guidance to the team. Ms. Charlotte Campbell, Program Manager of the Human Resources Research Organization, Advanced Distributed Training Program was program manager for the project and provided valuable input and assistance. Mr. Jeff Abbott, the project lead for the Close Combat Tactical Trainer (CCTT) Exercise Initialization Tool (CEIT) project, worked closely with the Commanders' Integrated Training Tool (CITT) for the CCTT in the integration of CEIT into CITT.

Additionally, we had support from the following organizations:

- Directorate of Training and Doctrine Development (DTDD), Fort Knox, Kentucky
- The Non-commissioned Officer Academy, Fort Knox
- The CCTT Sites at Fort Knox, Fort Benning, Georgia; Fort Riley, Kansas; Fort Hood, Texas; Fort Carson, Colorado; and Fort Stewart, Georgia
- Armor Captains Career Course, 3rd Squadron, 16th Cavalry Regiment, Fort Knox
- Numerous advisors on training for security and support operations, primarily liaison officers at Fort Knox. These included Lieutenant Colonel Michael J. Clements from the United Kingdom, MAJ Geoffrey Hall from Canada, MAJ Scott Williams from the U.S. Marine Corps, and MAJ Darrin Ricketts from the DTDD at Fort Knox.

A special thank you to Ms. Peggy Salmon, Northrop Grumman Information Technology, who provided invaluable editorial support and assistance in the preparation of this report and all project deliverables.

THE COMMANDERS' INTEGRATED TRAINING TOOL FOR THE CLOSE COMBAT TACTICAL TRAINER – 3: FINAL PROTOTYPE DEVELOPMENT

EXECUTIVE SUMMARY

Research Requirement:

The U.S. Army is currently fielding the Close Combat Tactical Trainer (CCTT) as the first member of the Combined Arms Tactical Trainer family. The CCTT provides a virtual environment supporting the collective training of armored and mechanized infantry units. To maximize its effectiveness, the CCTT will be fielded as a complete, integrated training system (i.e., in addition to the basic hardware and software that comprise the system it will also provide the tools required to enable its users to achieve maximum benefit from its use). As CCTT training tools, techniques, and procedures have evolved, the need has increased for integrating them so that commanders and other unit trainers can access and use them readily and effectively. Such an integrating system or tool should: (a) provide trainers with ready access to all the information and methods they need to exploit the capabilities of CCTT; (b) be compatible with Army training management information systems and databases; (c) lead users to effective and efficient methods for developing and implementing training by providing ready access to available exercises, associated training support packages (TSPs) and other materials; (d) provide users with an understanding of and means to apply a structured approach to meeting training requirements; and (e) address the training of digital forces.

From October 1997 to January 2000, two projects to research and develop the Commanders' Integrated Training Tool (CITT) for the CCTT, a tool having the characteristics described above, were completed. These projects resulted in the design of the objective CITT and the development of a prototype system. The design was presented in the form of Integrated Definition (IDEF) models and Node Tree Diagrams; the prototype was delivered as a desktop software application, a Web Site, and two information videos. Upon completion of these projects, several new research and development (R&D) requirements were identified including the need to produce a fully-fieldable CITT based on additional formative evaluation (FE) and further integration of the CCTT Exercise Initialization Tool (CEIT); the need to address additional training requirements, particularly those related to stability and support operations (SASO); the need to examine implementation approaches for CITT; the need to provide greater flexibility of file use to allow CITT to run on any computer system with sufficient resources; the need to integrate the latest CCTT enhancements; and the need to include institutional training programs in implementation approaches recommended. These needs were addressed in the present project.

Procedure:

The project objectives were accomplished through the completion of five major activities. During the first month of the project, a comprehensive R&D plan was produced and provided to the project contracting officer's representative for approval. Upon approval, FE was conducted using the methodology developed in the first two CITT projects. Based on FE findings, and on

the requirements related to CEIT integration, the inclusion of SASO exercises, the inclusion of enhanced CCTT capabilities, and increased flexibility of file use, the fully-fieldable CITT 2.1 was developed consisting of a desktop application and Web Site.

The implementation strategy and fielding plan for the CITT was accomplished by developing near-, mid-, and long-term plans which take into account current and anticipated Army requirements and changes in technology. The near-term plan was accomplished as part of the current project; the mid-term plan recommends the further evolution of CITT by migrating it to Microsoft Office 2000 and Windows 2000, and by including capabilities for other virtual simulation systems such as Fire Support Combined Arms Tactical Trainer and Aviation Combined Arms Tactical Trainer; the long-term plan recommends the complete integration of CITT into the Army Training Information Architecture.

The final activity of the project involved documentation of project activities, lessons learned, and recommendations relating to implementation and fielding.

Findings:

A fully-fieldable CITT 2.1, consisting of the desktop application and the Web Site were delivered to the Project Manager – Combined Arms Tactical Trainer. The desktop application was fielded to six CCTT sites. Implementation strategies and fielding plans for near-, mid-, and long-term were developed, and lessons learned were documented.

Although close coordination occurred between the CITT team and the contractor team developing CEIT, the completion schedules were different. This produced two major effects: the CEIT embedded in CITT is not the final version; and the ability of CITT with embedded CEIT to produce a usable exercise initialization file has not been tested. In fact, the only testing of the final CITT 2.1 was that conducted internally by members of the CITT development team. Additional testing will need to be conducted, particularly as later versions of CEIT are incorporated in CITT.

Utilization of Findings:

The specific audiences who will find the information contained in this report beneficial include: (a) designers and developers who continue further development of the CITT, (b) training unit and CCTT training site personnel, (c) simulation system developers, and (d) any member of the U.S. Army who wants to better understand the TSP development process. The CITT design is fully documented and can be used as the basis for the development of an integrated training tool under any of several fielding alternatives developed as part of the project. The CITT 2.1 application is fully functional, at least as far as its ability to produce a TSP to support collective training in the CCTT. It will be of benefit to both unit personnel interested in designing exercises specific to their needs as well as to CCTT site personnel involved in exercise development.

THE COMMANDERS' INTEGRATED TRAINING TOOL FOR THE CLOSE COMBAT TACTICAL TRAINER – 3: FINAL PROTOTYPE DEVELOPMENT

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THE COMMANDERS' INTEGRATED TRAINING TOOL FOR THE CLOSE COMBAT TACTICAL TRAINER – 3: FINAL PROTOTYPE DEVELOPMENT

Introduction

Beginning in October, 1997, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI)¹ Armored Forces Research Unit (AFRU) at Fort Knox, Kentucky, has undertaken three projects to develop the Commanders' Integrated Training tool (CITT) for the Close Combat Tactical Trainer (CCTT). The CITT is an automated collective training exercise development tool that has been developed around current simulation and training development technologies. It is designed to provide unit commanders and other unit trainers, as well as institutional trainers, with an automated process that supports the development of structured training exercises, and their corresponding training support packages (TSPs), for use in CCTT. The CCTT is a virtual training system that supports the training of collective tasks for armored and mechanized infantry units, including combat support (CS) and combat service support (CSS), at the platoon and company/team level. It includes the capability to support battalion task force (and perhaps brigade) training as command field exercises or as portions of larger integrated exercises.

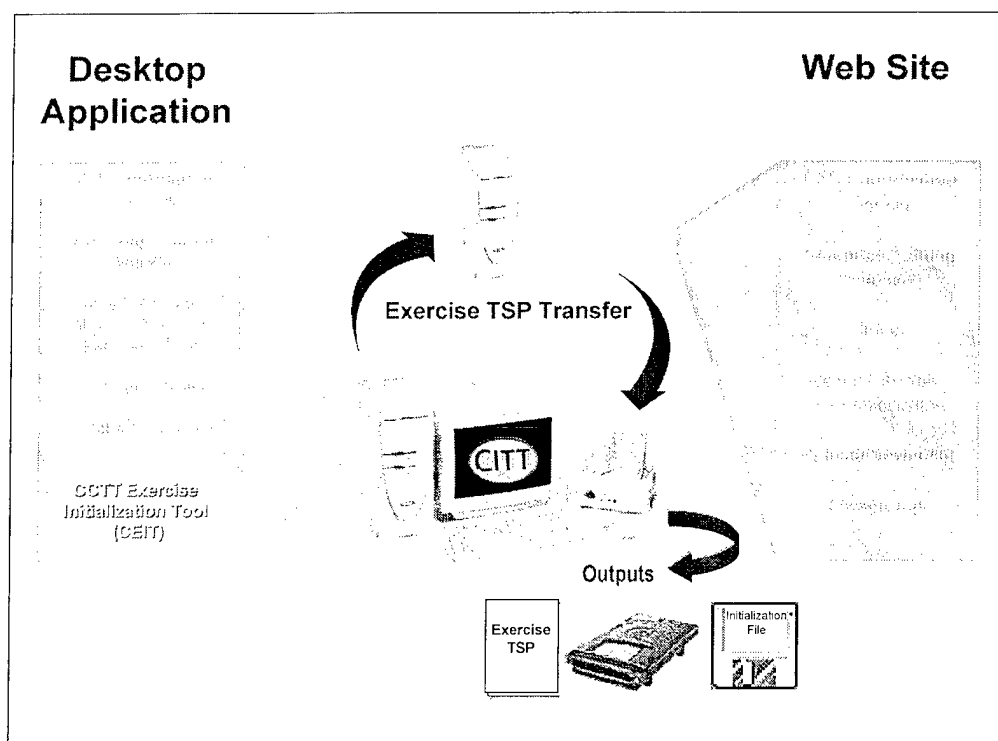
While support for CCTT is a prime function of CITT, it is equally important to recognize that CITT is firmly grounded in a proven training development process or model – the Instructional Systems Design (ISD) model also referenced for military training development as the Systems Approach to Training (SAT) process (Department of the Army [DA], 1999). More specifically, it fully supports a particular application of ISD, developed and refined over the last decade, known as structured training (Campbell, Quinkert, & Burnside, 2000). According to Campbell et al., structured training exercises have “five distinct characteristics: an explicit task focus, a realistic scenario, focused task performance feedback, a TSP to assist preparation and ensure standardization, and a linkage to a larger training strategy or family of programs” (p. 4). Structured training has been proven to be an effective training method (Campbell, Campbell, Sanders, Flynn & Myers, 1995; Bessemer & Myers, 1998; Flynn, Campbell, Myers, & Burnside, 1998, Deatz et al., 1998,) and the training development process employed in CITT leads the user to develop structured training exercises.

The first CITT project (Gossman et al., 1999) provided a detailed design and prototype system (CITT 1.0) for a tool that allowed commanders and other unit trainers to tailor the training their unit conducted in CCTT to their specific unit needs. This was accomplished by allowing commanders and other trainers to select from existing exercises if such exercises matched their training needs; by modifying an existing exercise to more closely match their training needs; or by creating an entirely new exercise that matches their training needs. In addition, the CITT provided extensive information on the CCTT and on developing structured training exercises. It was, in effect, a comprehensive source of information needed by users to participate effectively and efficiently in CCTT training, as well as a TSP authoring tool for exercises using the National Training Center (NTC) Primary Two (P2) terrain database (TDB).

¹ A list of all acronyms used in the report is included in Appendix A.

The second CITT project (Gossman et al., 2000) was directed at expanding and refining the CITT design and the prototype system based on findings from formative evaluation (FE) of CITT 1.0 and on the inclusion of expanded CCTT capabilities. It specifically sought to incorporate support for the CCTT capability to train Force XXI Battle Command Brigade and Below (FBCB2)-equipped units, the addition of the Temperate Forest (Primary 1 [P1]) and Fort Hood (P3) TDBs to the CITT, and an effective and efficient means for an interface between CITT users and CCTT site personnel. It also streamlined and simplified the TSP authoring process and the graphical user interface (GUI) employed in the prototype system.

The second CITT project resulted in the production of a prototype CITT 2.0 and an updated CITT Web Site as illustrated in Figure 1. However, because work on both continued up to the end of the project, there was no opportunity to conduct FE beyond internal testing by members of the CITT team, and a recommendation was made that a future project have FE of CITT 2.0 as its major focus. This was particularly critical since the user interface in CITT 2.0 had changed substantially from that used in CITT 1.0. In addition, integration of the CCTT Exercise Initialization Tool (CEIT)² into CITT was only partially completed since the CEIT development schedule ran about three months behind the CITT development schedule.



Note. CCTT = Close Combat Tactical Trainer; CEIT = CCTT Exercise Initialization Tool; TSP = training support package.

Figure 1. Prototype Commanders' Integrated Training Tool for the Close Combat Tactical Trainer (CITT) desktop application and Web Site from the CITT-2 project.

² The CEIT is a Microsoft PowerPoint Add-in which provides the user the capability to develop detailed exercise maps and overlays; to specify friendly and enemy forces' task organization, environmental conditions, and radio nets; and to produce an exercise initialization file for use at the CCTT site.

In January 2000, ARI initiated a project to address these issues as well as several others that had arisen. Specifically, the project statement of work ([SOW] ARI, 2000) identified the following:

- A need to conduct FE of CITT 2.0 to identify and accomplish additional refinements needed;
- A need to evaluate and refine the integration of CEIT with CITT;
- A need to expand CITT to provide support for units to use CCTT to address unique training requirements, such as preparation for contingency or stability and support operations (SASO³) that are increasingly arising for small units, including providing guidance to unit trainers and exemplary TSPs;
- A need to continue examination of implementation approaches, including fielding and sustainment methods, as well as key design considerations such as compatibility with new software packages and Army information systems.

In January 2001, based on additional needs which had arisen, ARI extended the project and issued a modification to the SOW that added the following requirements:

- A need to include the provision of greater flexibility in file use (e.g., help files, TDBs) to allow CITT to run properly on any computer/computer system which has sufficient storage resources;
- A need to integrate, to the extent possible, into CITT the latest enhanced CCTT capabilities, such as the merger of capabilities into workstations for Semi-Automated Forces (SAF);
- A need to include institutional training programs, such as the University of Mounted Warfare (UMW) at Fort Knox, in implementation approaches recommended.

The project to address these concerns was designated the Commanders' Integrated Training Tool for the Close Combat Tactical Trainer – 3 (CITT-3) and is the subject of this research report. This report describes the research methods and outcomes of the CITT-3 project, including the development of CITT 2.1, to address the stated concerns as well as recommended implementation methods including fielding and sustainment for near-, mid-, and long-term solutions.

³ SASO is used equivalently with SOSO (stability operations, support operations).

Organization of the Report

This report is organized as follows:

- The Project Background and Need section describes the need for the expanded and enhanced CITT 2.1 and the overall purpose of the project, including a statement of the project objectives.
- The Refine and Enhance CITT section describes the methodology used to produce CITT 2.1.
- The Implementation and Fielding section provides detailed recommendations for the CITT implementation methods, including fielding and sustainment, for near-, mid-, and long-term solutions.
- The Lessons Learned section describes findings from the project that are relevant to future similar efforts.
- The Summary and Recommendations section provides a brief synopsis of the report and presents a number of recommendations for future efforts.

A list of the acronyms used in this report is located at Appendix A. A complete list of references examined during the project is included in Appendix B. A detailed list of proposed enhancements was provided to the Project Manager – Combined Arms Tactical Trainer (PM CATT) and is included in Appendix C.

Project Background and Need

Although the second CITT project was completed successfully, there remained several research and development issues relating to CITT that needed to be addressed. The CITT-2 resulted in a CITT version (CITT 2.0) that represented a refinement of earlier versions based on the results of FE. However, the user interfaces in CITT 2.0 were changed considerably from earlier versions, and there was a need to conduct FE of CITT 2.0 with users to identify and accomplish additional refinements that might be needed. Of particular concern here was the evaluation and refinement of the integration of PM CATT-developed CEIT with CITT. There was also a need to expand and/or revise CITT in several areas to increase its capabilities including the provision of greater flexibility in file use, and the integration into CITT of the latest enhanced CCTT capabilities related to SAF. A primary area of interest here was the provision of support in CITT for units to use the CCTT to address unique training requirements, such as preparation for contingencies or SASO, that are arising increasingly for small units (e.g., escorting a convoy or overwatching a traffic control point or roadblock). The SASO support needed in CITT included guidance to unit trainers and the inclusion of exemplary TSPs. In addition, as further CITT design continued, there was a need to continue examination of implementation approaches, including fielding and sustainment methods (particularly for distributed access to the CITT and for implementation in institutional training programs such as

the UMW at Fort Knox), as well as key design considerations such as compatibility with new software packages and Army Information Systems.

Continuing research and development was needed to evaluate, refine, and expand the CITT 2.0 to support commanders and other unit trainers in exploiting fully the capabilities of the CCTT for training conventional and digital forces. The CITT-3 project sustained the focus at company/team and platoon levels, as well as continuing design and development within a brigade training context addressing the fit of the CCTT in a combined arms training strategy. This provided an appropriate tactical training framework and supports possible future expansion.

Refine and Enhance CITT

In accordance with the requirements described previously, the refinement and enhancement of CITT was accomplished around a number of distinct activities: conduct of FE, continued integration of CEIT, inclusion of contingency and SASO information and prototype exercises, provision of greater flexibility in file use, and inclusion of enhanced CCTT capabilities. Each of these is described in the following sections.

Conduct Formative Evaluation of CITT 2.0

The FE of CITT 2.0 was conducted using the methodology that was employed in the two previous CITT projects and was described in great detail in the reports for those projects (Gossman et al, 1999; Gossman et al., 2000). In order to conduct FE, limited implementation of CITT 2.0 occurred at the following locations:

- The CCTT site and units at Fort Hood, Texas;
- The CCTT site and units at Fort Benning, Georgia;
- The CCTT site, an institutional training program (Armor Captains Career Course [ACCC]), and with additional personnel at Fort Knox;
- A PM CATT site at Orlando, Florida; and
- A TRADOC [U.S. Army Training and Doctrine Command] System Manager (TSM) Combined Arms Tactical Trainer (CATT) site at Fort Leavenworth, Kansas.

Data were also gathered from: the Simulations Operations Course (i.e., Functional Area 57) at the National Simulation Center, Fort Leavenworth, and other users of CITT throughout the project (e.g., the UMW Armor Conference demonstration).

To support the continued limited implementation of the CITT system, government-furnished CITT computers were updated with the latest CITT software (version 2.0) and users were provided initial training on the CITT system (i.e., CITT 2.0 and CITT Web Site). In addition, the government point of contact (POC) for each site was trained to provide limited support for CITT including support for FE.

The team conducted FE by monitoring the use of the CITT system by military unit personnel, CCTT site personnel, and other users through recording all problems and deficiencies encountered. While all aspects of the CITT 2.0 application were evaluated, the primary focus was on the user interface and integration of CEIT with CITT. The PM CATT contractor (AccuSoft) developing CEIT did not have a requirement to conduct external evaluation. Therefore, we worked with AccuSoft to accomplish limited CEIT evaluation by involving them in the development of specific test cases, surveys, and other materials used throughout the evaluation. We also provided all relevant feedback, suggestions, and requirements to the CEIT developers.

Data collection methods. Data were collected from CITT users at all implementation sites using one or more of the following methods: an embedded survey/questionnaire, operation of a help desk, usability assessment, and user interviews (see Gossman et al., 2000 for examples of data collection instruments used). The usability assessment portion of the FE ended July 30, 2000.

A user survey/questionnaire was developed and included in the CITT 2.0 application. All users were strongly encouraged to complete the questionnaire. The CITT 2.0 embedded survey/questionnaire results were retained in the CITT application until retrieved. To obtain the user survey/questionnaire from the test sites, each CITT computer was equipped with a removable storage device (e.g., a ZIP drive), and the site POC was instructed on procedures necessary for survey/questionnaire data retrieval. Once extracted the data was sent to the project evaluator. These procedures were identical to the ones employed during the CITT-2 project.

Another feature of limited implementation was the continued support for CITT users and administrators by providing a CITT Help Desk to assist CITT users in the field via both telephone and electronic mail (e-mail). The Help Desk was accessible by telephone during normal business hours (0800-1700 Eastern Time) and by e-mail. Although the help desk received limited calls or e-mails, the information it provided was useful in the development of the refined CITT.

The data collection methodologies described above are somewhat passive in that they rely on CITT users to access the system and develop and provide feedback via the survey and/or report problems. Direct observation, on the other hand, involved exercising the CITT system under relatively controlled conditions. While all test participants were involved in usability testing of the CITT system, individual participants were tasked to test different modules or parts of it. The CITT team observed this component of the evaluation, and additional data were collected using structured observations and interviews similar to those employed in previous CITT projects. Consistent with the SOW, data were collected using passive observation techniques. The objective of direct observation testing was to determine CITT's ability to provide commanders, other unit trainers, and other supporting personnel with the capabilities to:

- Select, modify and create CCTT exercises on selected TDBs,
- Access, modify, create, and print required training support materials,

- Access and use the CITT Web Site including uploading and downloading TSPs, and
- Provide other unit personnel with the capability to access required information necessary to support the execution of exercises created or modified.

Direct observation occurred at Fort Hood, Fort Benning, Fort Knox, and Fort Leavenworth during the months of April through July 2000. During testing, data were collected by monitoring participants and by interviewing and/or administering questionnaires to participants.

The following data were collected:

- Successful outcome reached (e.g., exercise was selected, created, or modified, etc.),
- Navigation errors (i.e., participant had to “back up” to get back on task; participant went down a path that did not lead to desired outcome),
- System errors (e.g., links not working correctly, buttons not working, help screens not working, etc.),
- Usability measures (e.g., “look and feel,” ease of navigation, ease of use, etc.),
- Functions and features omitted,
- Desired system changes.

The methods employed to collect information changed throughout the project. During the early stages of the project, evaluators focused their attention on specific processes that they needed to assess. For example, early evaluation utilized a practical exercise (PE) that was developed to test specific aspects of the exercise development process. These evaluations were aimed at determining if users were able to use the CITT system to develop the PE, and errors encountered and user recommendations were recorded.

During later tests, users were given a specific test case – a set of instructions to complete a specific set of tasks without assistance from the evaluation team. Data were collected to document problems encountered during the test case. The focus of this evaluation was on the capabilities of the system to provide an ample amount of instruction and help to complete the tasks. In order to meet the real needs of those participating in direct observation, test cases were tailored specifically to those participants. For example, if the participant was in a digitally equipped unit, a test case involving creation of a digital exercise or conversion of a conventional exercise to digital was used.

Following completion of direct observation sessions, participants were interviewed using the structured interview questionnaires and methods employed in the CITT-2 project (Gossman et al., 2000).

Data analysis. The data collected during FE were analyzed for implications and recommendations to the refinement of the CITT system. Each data collection method was designed for timely documentation of results so that information could be disseminated quickly to both designers and developers of the CITT system. Involvement of the designers in the evaluation process facilitated the completion of modifications to the exercise development process. Findings were documented as individual items in defect-tracking software that allowed CITT developers to review and monitor FE findings and user comments. All items were organized and analyzed by the team during bimonthly meetings, and findings were discussed to clarify the issues involved with each item. Once issues were clarified and appropriate corrective actions were determined, items were prioritized and a timeline for accomplishing the revisions to the CITT products was produced.

The analysis of all FE data focused on the following:

- Identification of problems/defects which required an immediate fix,
- Identification of problems/defects which could be fixed in CITT 2.1,
- User impressions concerning the CITT and CEIT interface, operation, functionality, etc.,
- User feedback on which modules/functions of CITT are particularly effective/ineffective,
- Impressions of the CITT Web Site, and
- Recommendations for future CITT development.

Modifications to CITT in response to formative evaluation. Forty-four users participated in the direct observation phase of FE. This accounted for 226 hours of assessment using the data collection procedures described above. Thirteen debriefing sessions occurred and 18 user surveys were also collected. The information collected from direct observation, surveys, and debriefing sessions accounted for 162 items including desired enhancements, suggestions for refinement, defects, or general statements. An additional 71 items were collected during internal testing for a total of 233. These items served as the basis for refinements to the CITT 2.0. In addition, as refinement proceeded, other modifications were made based upon input from the development team. Microsoft Agent was removed from the CITT application. The functionality Agent had provided was replaced by the inclusion of "Why? buttons"⁴ and Microsoft Assistant. Exercise management tools appropriate for CITT administrators and CCTT site personnel were added. Also, modifications to the Navigate CITT tools were made by removing them from the CITT main menu screen and incorporating them into the Learn About CCTT Module. Finally, the Mission Training Plan (MTP) tasks contained in the CITT database were updated. Several issues made this necessary. First, the task numbering mechanism employed across TRADOC changed. More importantly, the MTP sets used in CITT 2.0 were out of date and the revised

⁴ "Why?" buttons provide detailed descriptions of selected CITT tasks including the function the task serves in the overall exercise development process as well as instructions for completing the task.

CITT needed the newer MTPs. As a consequence of updating the MTP data, the exercises in CITT were updated to reflect the new task data.

Continued Integration of CEIT

The second major source of revisions/enhancements to CITT 2.0 stemmed from the ongoing work to integrate CEIT into CITT. The CITT team worked closely with the CEIT developers throughout the CITT projects. However, the two projects were on different completion schedules which sometimes made coordination difficult. In fact, one of the major reasons for the modification to the CITT-3 project resulting in its extension for six months was the fact that CEIT could not be run within CITT by the anticipated completion date for CITT-3. This was true for several reasons. While CEIT was tested by its developers as a stand-alone Microsoft PowerPoint Add-in, it was never tested running under CITT. When, in fact, the CITT team performed these tests, a number of errors and defects were found. These were reported to the CEIT developers over the course of the current project in the form of defect-tracking items. These reports served as the basis for frequent communication and coordination, including a total of three visits by the principal CEIT developer to Fort Knox, and two by CITT developers to Orlando, Florida. By the end of the CITT project all reported items were either "fixed" or otherwise accounted for. For example, some problems discovered are actually problems with the CCTT database and will require a modification to CCTT.

Another source of difficulty lay in the fact that CEIT had evolved substantially over the life of the CITT projects from a relatively simple map and overlay tool to a relatively complex exercise initialization tool. That is, CEIT now allows users to specify exercise initialization data such as starting locations for all entities (manned as well as computer-generated), starting conditions (time of day, weather, etc.), and command instruction sets for all forces controlled by various CCTT SAF workstations. Utilizing the additional data available from CEIT required modifications to the CITT data structure as well as to the mechanism for sharing data between CITT and CEIT – the shared database. Even after these modifications were accomplished, the CITT developers spent long hours testing CEIT not only to ensure that it worked within CITT but that it produced initialization data consistent with the operation of CCTT. The ultimate goals of the integration activities were to produce a CITT/CEIT that ran successfully with no fatal errors, that would produce an exercise initialization file that would satisfy all PM CATT specified requirements for export to CCTT, and that would successfully import such a file. In the end, the coordination between the two projects resulted in a functioning CEIT running within CITT which includes the following:

- A refined data transfer and data sharing mechanism for sharing data between CITT and CEIT,
- An improved and enhanced CEIT GUI,
- Embedded combat instruction set data (i.e., system instructions used to define the tactical combat behaviors of SAF units),
- Integrated user-focused error trapping within CEIT,

- Inclusion of the Kosovo TDB, and
- Inclusion of process-oriented contextual help for CEIT.

It should be noted that the integrated CITT/CEIT has been tested by users at the Fort Riley CCTT site and by members of the CITT development team. Because the exercise initialization features added to CITT/CEIT are relatively complex and require a high level of knowledge regarding the functioning of CCTT, it is recommended that extensive additional user testing be undertaken to determine the system's effectiveness. This testing should focus on usability of the CITT/CEIT and should address such questions as: "Do commanders and other unit trainers use all of the features of the system?", "Does the system enhance the CCTT site staff's ability to prepare an exercise for execution?", "Has the system, in attempting to mirror the complexity of CCTT, become so complex that it will not be used?"

Inclusion of Contingency and SASO Information and Prototype Exercises

As specified in the SOW (ARI, 2000), a further area for expanding CITT was the inclusion of support for units to use CCTT to address unique training requirements, such as preparation for contingencies or SASO, that are arising increasingly for small units. The primary emphasis of expansion was on providing guidance to CITT users for developing exercises to train these missions using CCTT, and on developing prototype exercises. A secondary purpose was to identify future CCTT enhancements needed to adequately support SASO missions.

To identify SASO related information for inclusion in CITT as well as appropriate prototype exercises, a review and analysis of available relevant information was conducted. This included an examination of existing armor and infantry MTPs, the Stability Operations Mission Training Plan "White Paper" (Seventh Army Training Command, 1995), Training Circular 7-98-1, Stability and Support Operations Training Support Package (DA, 1997), and other relevant sources.⁵ From this analysis, collective tasks for small units conducting SASO missions were identified. These tasks were analyzed using the assessment procedures identified in the CCTT Accreditation Report (CCTT Accreditation Team, 1999) to identify those that could be effectively trained in CCTT. This consisted of analyzing each task to assess the fidelity of execution in CCTT and the ability to provide appropriate feedback to the performing unit. Additional considerations concerning task appropriateness were based on CCTT limitations. Specifically, CCTT is designed to train close combat tasks in conflict environments rather than stability or support tasks in peacekeeping environments. Threat forces are based on armor and mechanized opposing forces, and no models of civilian personnel or vehicles currently exist. Furthermore, urban areas appear with limited fidelity replicating building exteriors only. Finally, the Dismounted Infantry Module (DIM) allows for training of dismounted infantry only up to platoon level and with limited fidelity. Based on the task analysis and with these limitations in mind, a list of tasks was selected that served as the basis for the design and development of the prototype SASO exercises.

The methodology used to develop the prototype exercises was adapted from the structured simulation-based methodology employed to develop the Structured Training for Units

⁵ A complete list of references examined is included in Appendix B.

in the Close Combat Tactical Trainer (STRUCCTT) exercises (Flynn, Campbell, Myers, & Burnside, 1998) which is illustrated in Figure 2. An initial decision was made that the exercises would focus on stability operations versus support operations within the context of peace enforcement missions. This decision was based on two considerations: The CCTT better supports stability operations; and peace enforcement operations have become increasingly common in the post-Cold War strategic security environment. Exercise scenarios were developed around stability operations missions that realistically supported the tasks selected for training in CCTT. Exercise outlines based on the scenarios were developed along with supporting tactical materials (maps and overlays and operations orders). These outlines and supporting materials were presented to a panel of military subject matter experts (SMEs) who had first-hand experience with SASO missions in Bosnia, Kosovo, and/or Haiti. Based on their feedback, the exercise materials were modified, and initial drafts were prepared and presented to the contracting officer's representative (COR) for approval. The exercises were then built and proofed at the CCTT site at Fort Knox and were tested using project team members and CCTT site personnel.⁶ Following revisions based on testing, the exercises were incorporated into the CITT exercise database. All exercises were written for mechanized infantry units and were developed for the P1 (Central Europe) TDB. Five exercises are for platoon; three are team exercises. Table 1 provides a list of the eight stability operations exercises.

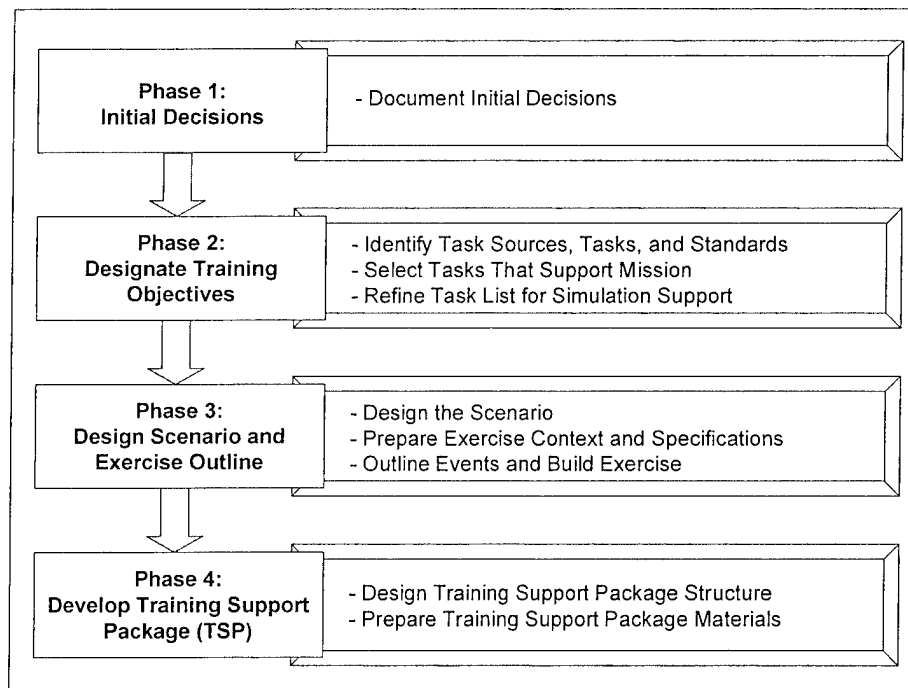


Figure 2. The training support package (TSP) development methodology.

⁶ Original planning specified testing by military personnel; however, this proved impossible due to scheduling difficulties.

Table 1

Stability Operations Exercises Developed During CITT-3

Exercise Name	Exercise Description
PMSA1-1WCS	Operate an Observation Post
PMSA2-1WCS	Operate a Checkpoint
PMSA3-1WCS	Conduct Presence Patrol
PMSA4-1WCS	React as a Quick Reaction Force
PMSA5-1WCS	Conduct Convoy Escort
TMSA1-1WCS	Establish Cordon
TMSA2-1WCS	Conduct Search
TMSA3-1WCS	Complete Cordon and Search

As stated previously, extensive materials related to SASO missions were analyzed to develop exercises. This analysis also served as the basis for determining additional information to be added to CITT to support users in creating, modifying, or selecting existing SASO exercises for training in CCTT. The Learn About CCTT Module was updated to include this material, and CITT now includes support for units to use CCTT to prepare for unique training requirements, particularly those related to SASO.

The final aspect of this activity involved an examination and analysis of CCTT enhancements that would give it the capability to more fully support stability operations. Based on information gathered, and with the assistance of the military SMEs described previously, a full analysis was conducted and enhancements to CCTT that would better enable units to prepare for SASO missions were identified. These proposed enhancements are intended to increase the fidelity of the training experience, and, in fact, may allow exercises to be developed for tasks that are not presently well supported. A detailed list of proposed enhancements was provided to the PM CATT and is included in Appendix C.

Greater Flexibility in File Use

Another area for enhancement to CITT concerned providing greater flexibility in file use to enable CITT to run on any computer/computer system with sufficient storage resources. In previous projects, specifications for machines capable of running CITT had been fairly tightly controlled (i.e., CITT was designed to run on machines having minimum hardware requirements that were relatively high-end, and which were running the Microsoft NT 4.0 operating system and Microsoft Office 97). This was not a problem as long as CITT was being delivered as a combined hardware/software system as had occurred in the first two projects. However, with the current project requirement that CITT go from a prototype to a fully-fieldable system, it became important that it be capable of running on typical user systems.

Experience from FE of CITT 1.0 suggested that units would not typically have the high-end system for which CITT was designed. To test this assumption more stringently, the team collected data on typical hardware/software systems available at user home stations. The

information was collected from FE participants and documented throughout the evaluation. The results of the hardware/software specifications survey indicated that the typical machine found at a unit home station consisted of:

- Pentium 66 megahertz (MHz) processor,
- 64 Megabytes (MB) of RAM,
- 4 MB of video random-access memory (RAM),
- 2 giga-byte (GB) hard drive,
- 15 inch monitor, and
- Windows 95 operating system.

This information was used to conduct benchmark testing of CITT by configuring a computer to closely match the typical specifications. However, several changes had to be made in order to conduct the testing. First, the operating system requirement for the CITT software is Windows NT 4.0. There are significant differences between Windows 95 and Windows NT 4.0 in file handling, particularly in where key files required for CITT need to be located. While not impossible to make CITT install on a Windows 95 machine, it was thought to be an inefficient use of project resources since that operating system is now three generations old and will undoubtedly be superseded in most Army applications in the near future. It was decided to examine running CITT under Windows 98 instead. Second, the minimum hard drive required to run CITT efficiently exceeds the 2 GB found on a typical machine. For these reasons, it was decided that the test machine would have the same hardware configuration as previously specified for CITT.

The team was successful in modifying CITT, without CEIT, to run in the Windows 98 environment. Modifications were made to those files necessary to make CITT compatible with Windows 98. The install files were modified to check for the operating system running on a machine, and the CITT installation was customized to install on either operating system. When CEIT was embedded in CITT, however, the system no longer worked properly. Extensive testing was conducted to determine the source of the problem; however, the CITT developers were unable to pinpoint the exact cause, and the CEIT developer, while expressing an interest in determining the source, also related that it would be a very low priority activity. For these reasons, no further attempts were made to install and run CITT on a machine other than its original design configuration. Future CITT development and/or sustainment may well want to reconsider this issue.

Inclusion of Enhanced CCTT Capabilities

The final refinement to CITT specified in the SOW involved determining changes required to accommodate recent enhancements to CCTT itself. After completing initial research, it became apparent that the only enhancement that would impact CITT 2.1 was the Operations

Center/Semi-Automated Forces (OC/SAF) Merge. (Lockheed Martin EIS, 1999). The Operations Center (OC) workstations in the original CCTT configuration were used to command and control the emulated CS and CSS units required to support a CCTT training exercise during runtime. The OC workstations were typically manned by Army personnel from the actual CS and CSS units assigned to support the unit being trained. The SAF workstations are used to command and control the emulated combat units during exercise runtime and are operated by CCTT site personnel. The need to employ Army personnel to operate the OC workstations sometimes led to difficulties in scheduling the necessary personnel, and, even more importantly, required these personnel to learn to operate the workstation itself. Even though training was available to do this, it still added to staffing and scheduling difficulties.

The PM CATT decided to merge the OC workstation functions with the SAF workstations, thus making the site-provided SAF operators responsible for commanding and controlling emulated CS and CSS units. All OC workstation functions have been migrated to SAF, although the fire support element (FSE), the mortar support (fire direction center [FDC]), and the field artillery battalion tactical operations center (FABTOC) workstations can be operated in an "either/or" mode. That is, these functions can be operated from the SAF workstation, or by the corresponding OC workstation if the training unit specifies. This provides greater flexibility to the training unit and to the site staff. It should be noted that the training unit can continue to include Army personnel serving the CS and CSS functions necessary to support the exercise; however, their role is to provide appropriate radio communications rather than to operate the workstation.

Implications of OC/SAF Merge on CITT were researched by analyzing existing documentation and Web Sites, and through site visits to the CCTT sites at Fort Knox and Fort Hood to observe workstation operation. The team determined that the impacts on CITT were in the Event Guide and Workstation Execution Guidelines components of the exercise and its corresponding exercise TSP. There were additional impacts on CEIT, particularly in the area of combat instruction set orders, which were passed on to the CEIT developers. Necessary modifications to the CITT database components and structure were made and the user interface was changed consistent with the modifications. Major changes were made to the engineering, fire support, and CSS guidelines included in CITT, and corresponding instructions were consolidated on the blue forces SAF Workstation. The CEIT changes were incorporated as part of the integration of CEIT activities described previously. Finally, the Learn About CCTT Module of CITT was updated to include information on the OC/SAF Merge and its implications for exercise design and development as well as staffing and execution.

The modifications and enhancements described in this section resulted in the CITT 2.1 as a fully-fieldable system as required in the SOW. This included 17 complete exercises. It should be noted that counting the exercises included in CITT 2.0, 8 SASO exercises, and 12 cavalry exercises from the original STRUCCTT project, there are approximately 60 exercises that are candidates for inclusion in CITT. The 17 actually included are those that were able to be successfully converted from CCTT software version 8.1 to CCTT software version 8.2. The next section of this report examines implementation recommendations for CITT 2.1, including fielding and sustainment issues as well as implementation considerations for future CITT or CITT-like systems.

Implementation and Fielding

Implementation and fielding strategies for CITT need to take into account its transition from a prototype research and development tool to a fully functional software system. The strategies need to examine such issues as how users will be trained, or at least familiarized, with the system; how information (TSPs) developed using the system will be disseminated and shared; and how the system will be supported and sustained. For the long term, the strategies need to also look at how CITT will be assimilated into the Army's overarching training strategies and systems. This section examines these questions for near-, mid-, and long-term fielding solutions.

Near-Term Solution

Near-term implementation consists of the initial fielding of the CITT along with its support and sustainment. In addition, it involves maintenance of CITT as fielded at the completion of the current project. No new or additional development is anticipated during this solution.

Fielding. Initial fielding of CITT 2.1⁷ was accomplished during the course of the CITT-3 project and consisted of fielding to selected CCTT sites, project sponsors, and one institutional location. The fielded CITT included the desktop application on CD-ROM, the *Getting Started User's Guide for CITT 2.1* (CITT Team, 2001a), and the *Commanders' Integrated Training Tool for the Close Combat Tactical Trainer System Administrator's Manual* ([SAM] CITT Team, 2001b). In addition, the CITT Web Site hardware and software was delivered to the PM CATT.

Project team members delivered, installed and tested CITT at CCTT sites at Fort Hood (two sites); Fort Benning; Fort Knox; Fort Riley; Fort Carson, Colorado; and Fort Stewart, Georgia. This included the delivery of user training to site staff personnel selected by site management. The training consisted of an orientation to CITT and its capabilities, and the execution of a PE on CITT. The PE is fully explained and documented in the *Getting Started Manual* (CITT Team, 2001a). The user training required approximately 2.5 hours per person. In addition, limited fielding was accomplished consisting of delivering CITT 2.1 software on CD-ROMs, along with supporting manuals, to ARI-Fort Knox, PM CATT, TSM CATT, 7th Army Training Center (ATC), and the Armor Captains Career Course (ACCC)-Fort Knox. These locations represented CITT sponsors (ARI, PM, and TSM) as well as installations (sites and institutions) to which CITT 2.0 had been fielded. The CITT 2.1 was not fielded to units; however, the expectation is that units will be the primary users of CITT at the CCTT sites in keeping with the original function of CITT as an exercise development tool for unit commanders and other unit trainers. Fielding to CCTT Mobile sites, to new CCTT sites, and other organizations during the near-term solution will be completed at the discretion of the PM CATT.

Training support package dissemination. An important fielding issue concerns how TSPs, or exercises, will be shared with other CITT users. Since a major function of CITT is to

⁷ For the near-term solution, CITT 2.1 refers to the CITT system with integrated CEIT version 2.0. It is important to recognize that CEIT development is ongoing, and the version included in CITT will likely undergo substantial changes in the future.

reduce duplication in exercise development by providing users access to TSPs developed by other users, there needs to be some means for providing this access. In the near-term, this will be one of the functions of the CITT Web Site. The Web Site will provide a central repository for storing user-produced exercises that are uploaded to it; the administrative function of the CITT Desktop application provides the upload capability. Similarly, the user can download an exercise from the Web Site using his or her Web browser; once downloaded, the Desktop application includes the functionality to import the exercise into the exercise database. While these processes involve complex file conversions and transfers, they are built into the applications and are transparent to the user. The real issue is determining which exercises get uploaded and whether exercises require approval prior to uploading to the Web Site.

There are several issues involved with determining which exercises get uploaded to the central repository. Assuming we are talking about unit-produced exercises (as opposed to proponent-produced), there is the issue of why should the unit want to upload it as well as the extra time involved in the upload process. The immediate answer is that making an exercise available to other units could greatly facilitate training of those units. On the other hand, it potentially opens the developing unit to question and criticism. In the absence of other incentives, it is very possible that the wish to avoid criticism will outweigh the desire to assist another unit; thus, the Army needs to take a look at the kinds of incentives that could be provided. As far as the extra time involved, CITT includes appropriate administrative functions for exercise transfer and upload which should minimize the time users will need to complete those activities. A second issue is a systemic one; that is, the system itself should not place barriers in the way of sharing exercises. This would be the case, for example, if some type of complicated or rigid approval process were instituted. If the Army takes the position that only a proponent can approve an exercise, it is likely that few will be offered as candidates. If, on the other hand, the position is taken that the unit considering an exercise for its own use is in the best position to judge its adequacy and quality, more units may be willing to upload exercises they have produced.

Exercise approval involves two questions: is the exercise itself tactically sound, and is it of high quality from a structured training standpoint? The first question is clearly the prerogative of the training unit, and, for this reason, it is recommended that the exercise be reviewed and approved through the unit's chain of command at a battalion/squadron commander level or higher. If approved at this level, the exercise should be considered for inclusion in the central repository, and therefore, uploaded to it. The answer to the second question requires a high level of expertise in structured training principles and techniques which may not be available in typical units. A review point should be established, perhaps at the proponent school, to determine the training quality of the exercise, and, based on this review, the exercise would be approved for inclusion or not (bearing in mind the caveat that a too strict approval process will undoubtedly discourage uploading). This review could also examine logistical questions such as whether the candidate exercise is essentially a duplicate of an exercise already contained in the repository. The goal of this approval process is not to keep exercises out of the repository, but rather to ensure that the exercises that are included are of the highest quality and provide the greatest training benefit.

Sustainment and support. At the completion of the CITT-3 project, the CITT Desktop and Web Site transitioned to PM CATT for sustainment and support. It is recommended that this occur by placing CITT under the existing PM CATT Post Deployment Software Support (PDSS) mechanism. It is further recommended that the current support mechanisms within CITT (Help Desk line and e-mail account) be maintained since these have been operational for several years and appear in a number of places in CITT and its supporting documentation.

It is anticipated that the support required for the Desktop CITT will be primarily in the areas of technical assistance on the software application or on the exercise TSP development process. Subject matter expertise in these areas needs to be available to the PDSS team. It is also anticipated that minor problems in the application itself will be uncovered as it receives greater use, and these will require programming support to correct. A mechanism for determining and controlling modifications to the CITT application needs to be established along with a procedure for deciding when to update existing fielded systems. It may be best to release software patches to existing fielded CITT systems only to correct major errors that may be discovered.

CITT Web Site maintenance and support will require system administration and maintenance expertise. In addition, the TSP administration functions related to transferring exercises to the central repository on the Web Site require actions by the administrator that will need to be performed on a regular basis. These actions, as well as other administration requirements are fully explained in the SAM for the Web Site.

It is difficult to predict the time-frame for the near-term implementation and fielding since its termination is dependent upon development of other systems, most notably CEIT and other members of the CATT family of simulators. It is likely that the CITT in its current configuration will need to be functional for at least a year.

Mid-Term Solution

Mid-term implementation and fielding is related primarily to expanding CITT in a number of significant areas while retaining its current form (i.e., a commercial off-the-shelf based application developed for a stand-alone desktop computer system and a corresponding Web-based application). It involves migrating CITT to the next generation of the Microsoft Windows operating system and the Microsoft Office Suite. It also includes staying current with and integrating the most up-to-date version of CEIT. It does not anticipate major changes to the way exercise TSPs are treated by the application (i.e., as a database record), although there will very likely be changes to the actual database elements and structure. The overarching function of the mid-term solution is to ensure that CITT remains a viable product with the broadest applicability until the long-term solution involving integration into the Army Training Information Architecture (ATIA) is feasible.

Areas for expansion. It would be possible to expand CITT to include development of exercise TSPs for all types of collective training, including live, virtual, and constructive. Recent work completed for ARI examined management and assessment of user-produced TSPs for collective training exercises (Gossman, Graves, Mauzy, & Clagg, 2001) and found that the basic

components of the TSP are common for all exercise types in all environments (although some components may not be applicable to some exercises). In fact, work is currently underway at the TRADOC Army Training Support Center (ATSC) to develop a universal database specification for TSPs for collective training exercises based on these findings. It would certainly be possible to expand CITT to utilize these database specifications so that TSPs could be developed for any collective training exercise.

One major problem with this approach, however, lies in the area of the TSP components required to initialize an exercise in a specific training simulation system. Some of these systems are still in design and specific details of their exact data requirements have not yet been determined. Also, some of the existing systems are undergoing major revisions to how exercises are controlled (the migration from OC Workstations to OC/SAF Merge Workstations, for example) and assessed (the enhanced After Action Review System, for example) such that it is probably not feasible to develop a system based on a universal TSP components list at this time. The alternative is to expand CITT for specific training systems.

It is quite feasible at the present time to incorporate TSP requirements for the Aviation Combined Arms Tactical Trainer (AVCATT) and the Fire Support Combined Arms Tactical Trainer (FSCATT). The FSCATT has been fielded at a number of locations and AVCATT is scheduled for fielding soon. A third strong candidate is the Virtual Leader Effects Trainer (VLET). In fact, any of the virtual and constructive simulation systems which support collective structured training exercises should be examined for inclusion in CITT or a CITT-like system. If they are far enough along in development that the specific form and contents of TSPs can be determined, they should be considered.

Migration to Microsoft Windows 2000 and Office 2000. The CITT 2.1 was developed for Microsoft Windows NT 4.0 and Microsoft Office 97. Windows NT is now nearly two generations old (Windows 2000 has been released, and Windows XP is scheduled for release very shortly). And Office 97 is, in fact, two generations old. Office 2000 and Office XP have both been released. To prolong the life of the CITT, it should be migrated to newer versions of Windows and Office. As of this writing, the recommendation is to migrate to Windows 2000 and Office 2000. However, depending upon when migration actually begins, it may be feasible to migrate to Windows XP and Office XP also (i.e., have versions of CITT that run under either operating system). The determining factor should be the prevalence of those operating systems and office suites on typical Army computers. The Army will always have a mix of operating systems and office suites, just as it currently does; however, it is only prudent to attempt to anticipate which will be in greatest use during the majority of the life span of a given application and to develop the application accordingly.

Continued integration of CEIT. As described earlier, CEIT development is continuing independently of CITT and for a variety of systems other than CCTT. In addition, it is changing as a function of which version of Microsoft PowerPoint it is developed for (which may or may not cause problems for CITT). Since CEIT has become an integral part of the TSP development process, it is absolutely necessary to ensure that it runs in CITT as a seamless embedded application.

Consistent with ensuring CITT/CEIT compatibility, the mid-term solution should also examine making CEIT more user friendly. The CEIT itself is complex primarily because the part of exercise development for which it is utilized is complex. There are many data elements associated with each entity in an exercise, whether manned or simulated, and they interact in complex ways. One of the major shortcomings of the current CEIT 2.0 is the lack of comprehensive embedded user help that goes beyond simply providing the user with procedural instructions. The mid-term solution should consider the development of a comprehensive help system which not only provides information to the user on what to do, but also on why it should be done and what its implications are for other actions that will be taken.

Fielding. The CITT Desktop application developed as part of the mid-term solution would be fielded to all training locations (simulation sites and schools) which it supports, and to units, at least down to battalion level, who will be training at those locations. Because distribution of the mid-term CITT will be much more widespread than the near-term system, and since it will be distributed purely as a software system, it needs to be compatible with the broadest range of current Army computers at the time of its delivery. This will very likely mean having versions that will run under different operating systems and different versions of the office suite. The installation package would detect the user's operating system and office version, and would install the appropriate files necessary to run CITT in that environment. It should be noted that selection of the battalion as the echelon for fielding is somewhat arbitrary. There would, in fact, be no barrier to fielding CITT to any soldier involved in developing collective training exercises as long as he or she had a machine capable of running it. The primary triggers for fielding are first, that CITT has been enhanced to include full functionality for developing exercises for all supported training systems, and second, that it can import and export the initialization data required by the simulation system for which an exercise is written.

The mid-term solution should continue to update and maintain the Web Site. The site should be expanded and modified to support training in environments other than CCTT, but should continue to serve the same basic functions that it serves in the near-term plan. It would provide basic information and training to Army personnel and would continue to serve as a repository for user-produced collective exercise TSPs. This function will assume increasing importance, in fact, since the mid-term solution continues to employ a database of exercises embedded in the application, and the size of this database will become quite large as more and more exercises for various training environments are added. Fewer exercises could be stored on individual user's systems while still having ready access to many exercises via the Web Site.

Exercise dissemination. Exercise dissemination in the mid-term solution would be the same as in the near-term. Users would be able to upload and download exercises from the Web Site to use as-is or to modify to fit their specific training needs. Approval for uploading exercises to the Web Site would continue to reside with the developing unit. Approval for including the exercise in the central repository would be made by the proponent school involved.

Sustainment and support. System sustainment and support would also be handled as in the near-term solution. Once developed as a fully functioning system, the enhanced and expanded CITT would be placed under PDSS, most likely under supervision of PM CATT. It is possible, however, that the training domain and training devices served by CITT could exceed

those included in the CATT family, in which case, CITT could be placed under control of a different organization.

Long-Term Solution

In the long-term solution, development and implementation of CITT will be directed at making it disappear as a separate, independent entity, and instead, fully integrating its functionality into the ATIA. The ATIA is based on the Army Training XXI Campaign Plan (TRADOC, 1997) and will be a system of systems that will be developed over the next several years to provide the functionality for future training systems in the Army. The ATIA is a standards-based, data-driven, object-oriented system based on the Army's SAT process and applies to all Army training described in TRADOC Regulation 350-70 (DA, 1999). The ATIA specifies activities for designing, developing, implementing, assessing, and managing collective training, including the user-produced exercises and TSPs produced by CITT.

The ATIA is being developed by TRADOC under a set of principles and guidelines that provide the strategic guidance for a coherent technical framework for future Army training. Of particular relevance are the following:

- Data access should be logically centralized, but physically dispersed.
- Software applications and data should be segregated.
- All training information will be available and tailorable through training management systems.
- Training management systems will provide for one-time data entry to update all related systems' databases.

The concept of operations for the ATIA calls for nine Automated Information Systems (AIS), each of which is comprised of software segments largely drawn from as-is (e.g., CITT) and objective systems (ATSC, 1998). The AIS include, for example, training analysis, training design, training development, and training implementation. Using a self-organizing-to-task process, ATIA will "build" an application for the user depending upon his or her needs and user type (unit or institutional, for example). The training system will "gather" required supporting information from the Reimer Digital Library (RDL), satisfying the requirement that applications and data are segregated. Using the application "built" by the training system, the user will be able to perform specific training activities, such as developing a collective exercise TSP.

Obviously this is a somewhat simplified view of a very complex system; however, it does provide a picture of where CITT would fit into the overall process. The TSP development components of CITT (Create and Modify TSPs) would become a software segment within the Development AIS. It is also possible that certain functions within CITT would fit into the Analysis and Design AIS. The CEIT component would likewise become a software segment, also primarily in the Development AIS. The specific use of the AIS depends on who is using them. The ATIA has identified six "objective user configurations." The user configuration most

relevant to CITT is the Unit Training Management Configuration (UTMC), although the Institutional Training Management Configuration (ITMC) should also be examined. In fact, the UTMC will subsume the current functionality of the Standard Army Training System (SATS), while the ITMC will subsume the current functionality of the Automated Systems Approach to Training (ASAT), both of which include TSP development functions.

The "CITT-like" software segment would basically be pure code that leads the user through the TSP development process. All of the supporting data (MTP task lists, database of TSPs, etc.) that are currently part of the CITT application would become data objects residing in the RDL. In fact, each component of the TSP, as identified by Gossman et al. (2001) could be treated as a data object. The Object Instance Generator would assemble the data objects needed for a specific instance of TSP development. Similarly, TSPs produced could be stored on the RDL or on the user's local computer depending on the rule set developed for storing and disseminating user-produced TSPs. The current functions of CITT that primarily support TSP development, such as the Learn About CCTT Module, would also become objects stored on the RDL.

Assimilating CITT into ATIA. Detailed analysis to determine the best way to achieve the assimilation of CITT into ATIA will be required. While the ATIA specifications indicate that some current training systems will be incorporated into ATIA "as is," it is likely that CITT will need a considerable amount of modification. It is currently a self-contained database application with all supporting data needed to develop TSPs, as well as the TSPs themselves, embedded in the application itself. This would change under ATIA. In addition, it remains to be determined whether the best solution for the TSP development software segment is to employ Microsoft Access, or whether a custom application using some other development language will be required. Answers to these questions cannot be determined until actual design specifications for the ATIA are considerably further along.

Training support package dissemination and approval. In the previously referenced ARI sponsored research examining management and assessment of user-produced TSPs (Gossman et al., 2001), the issues of TSP approval and dissemination were treated extensively. A brief summary is provided here; for further discussion refer to Gossman et al.

Approval of TSPs is viewed from the standpoint of five levels of assessment as illustrated in Figure 3. The first level involves the developing unit whose concern is with the tactical correctness of the exercise and its applicability to the unit's training needs. The second level is completed by site personnel and determines whether the exercise will actually run in the environment (simulated or live) selected. The third level is conducted by unit and site personnel and determines whether the exercise was effective in achieving the training results for which it was developed. The fourth is completed by the proponent organization and addresses whether to include the exercise in a centralized database. And the fifth is completed by a unit considering whether to "adopt" the exercise, with or without modification, for its own training needs.

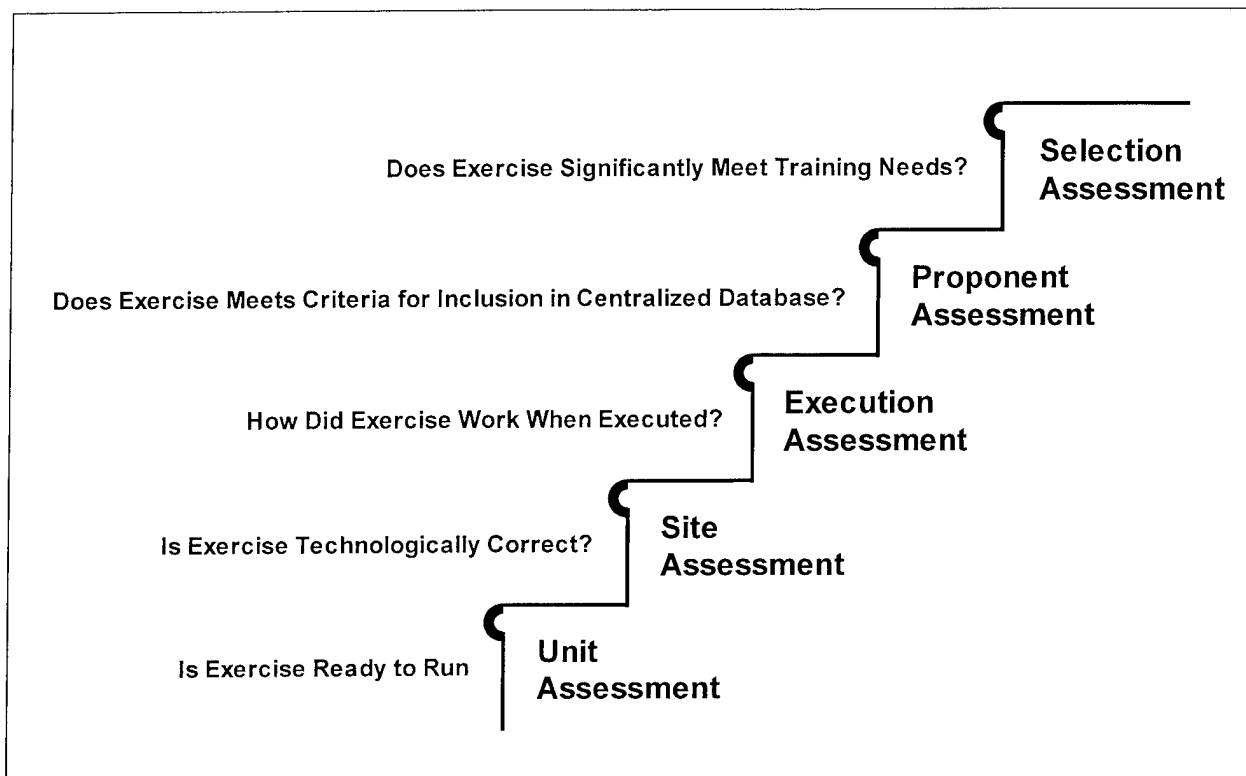
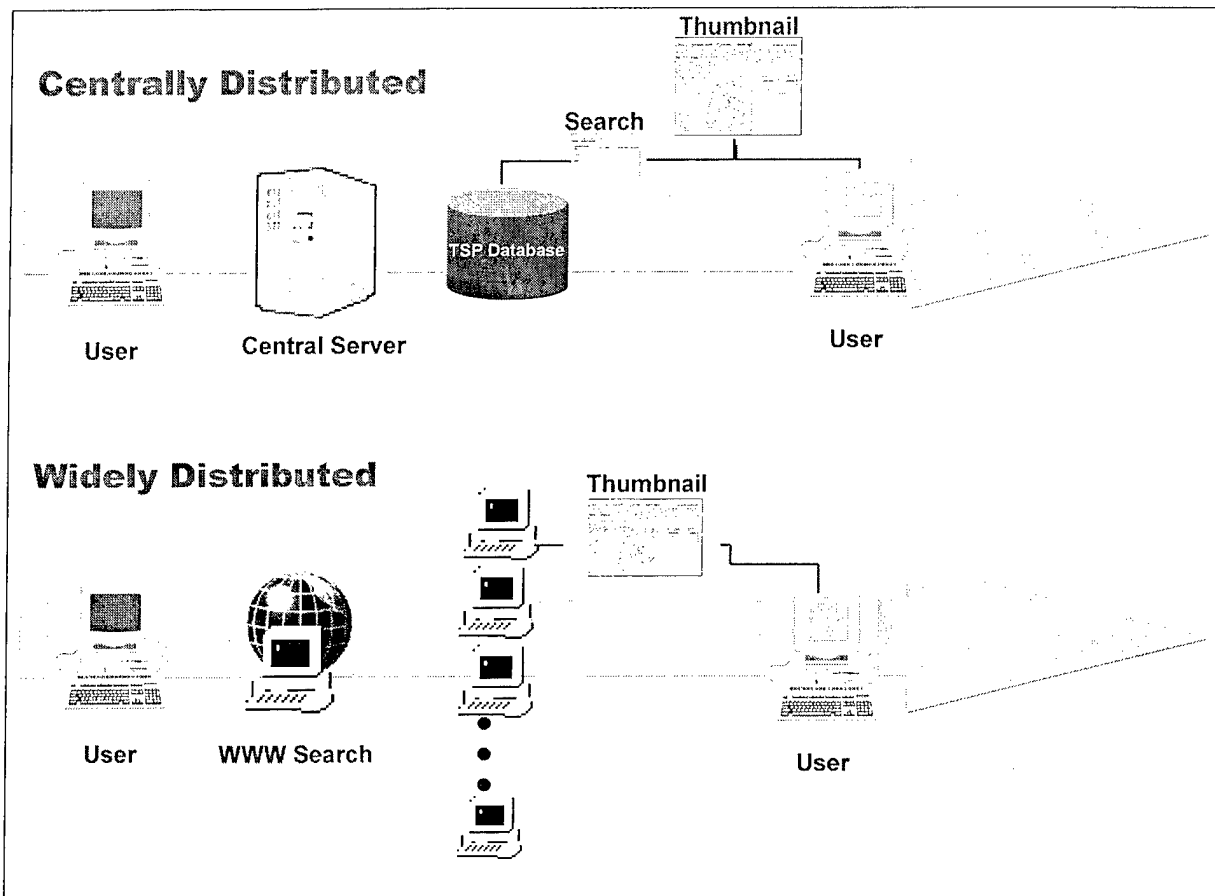


Figure 3. Training support package assessment levels.

These levels of assessment, or approval, obviously go beyond those discussed for the near- and mid-term solutions since they address additional issues beyond simply whether to include an exercise in a central repository. In addition to that issue, they are concerned with providing sufficient information to potential users to assist in the decision-making process involved in deciding whether an exercise fits a user's needs, and whether it appears to be of high quality.

Exercise dissemination or distribution is based on making the greatest number of exercises available to the greatest number of users. It also recognizes that only a small percentage of user-produced TSPs will probably be stored on the RDL. Thus, a two-pronged approach to TSP distribution is recommended as shown in Figure 4.

As illustrated, TSPs would be distributed either from a central repository (the RDL) or from individual users' Web Sites. TSPs on the RDL would be data objects or would be assembled from TSP components that are data objects. The TSP development software segment would then lead the user through the TSP development or modification process.



Note. WWW = world wide web.

Figure 4. Training support package (TSP) distribution methods.

Under the widely distributed methodology wherein TSPs are made accessible from individual users' Web Sites, on the other hand, an appropriate software segment for locating the TSP and importing it to the user's system would need to be developed. It would then be handled just as a TSP on the RDL is handled.

Sustainment and support. As part of the ATIA, sustainment and support of the "CITT-like" software segment will be fully under the control of the ATSC.

Lessons Learned

Few new lessons learned were derived from this project – most are reinforcements of ones discovered in the first two projects. Previous projects had concluded, and it was confirmed during CITT-3, that use of CITT is still facilitated by having a thorough understanding of the structured training process. Also, it continues to be very difficult to integrate a software application into another application when both are undergoing significant development and are changing frequently.

Two findings that did stem directly from the current project, however, do provide valuable lessons. First, retrieving data from the RDL is not yet the relatively seamless process that will be needed in the future when ATIA becomes a reality. In most cases data needed to be "cleaned-up" before being imported into CITT, and in some cases, the tables in CITT required modification before the data could be imported. This is somewhat to be expected in developing systems, particularly something as complex as the RDL and will undoubtedly become less difficult as complete integration among training systems occurs in the future.

The second lesson is related and also should be alleviated as ATIA is fully realized. When initial CITT development began, the TSP model used was taken from the STRUCCTT projects, and the database (tables and structure) for CITT was developed around it. Furthermore, the database was fully integrated into the application. This limits the ability of CITT to transfer or share TSPs with other systems or even to make TSPs available to other users. Future development needs to be done in the context of a total Army training system wherein sharing of data becomes transparent to users, and in which applications are built around databases that have been designed for seamless access by all systems having need for the data they contain.

Summary and Recommendations

This report has described the third in a series of ARI-sponsored projects to develop the CITT – a tool for commanders and other unit trainers, as well as institutional trainers, to maximize their training experience in CCTT by producing exercises that fully address their specific training needs. The CITT facilitates the development of structured training and allows users to produce TSPs by modifying existing ones or by developing new ones. At the completion of this project, CITT went from the prototype system developed during the first two projects to a fully-fieldable desktop application and Web Site. Based on FE of previous versions, improvements were made to the basic CITT GUI and TSP development process; modifications were made to the Learn About CCTT Module including incorporating user navigation aids; and additional administrative tools were added including tools for CITT administration and tools for CCTT site staff. The CITT was also enhanced to include guidance and prototype SASO exercises as well as support for OC/SAF Merge. Finally, the latest version of CEIT was fully integrated resulting in the capability to produce a file for initializing exercises at the CCTT site. The CITT Web Site was modified to reflect the changes to the desktop application, a search feature was added, and all exercises fielded with the desktop CITT were included in the Web Site exercise repository.

The report also described and discussed fielding and implementation requirements and recommendations for three options: near-, mid-, and long-term. Near-term fielding is underway and involved delivery of the CITT and initial user training at six CCTT sites and delivery of CITT only to ARI, 7th ATC, ACCC at Fort Knox, TSM CATT, and PM CATT. In addition, TSP approval and dissemination recommendations for this alternative were discussed.

Mid-term fielding recommendations were made that include enhancing CITT for use with other training systems (e.g., AVCATT, FSCATT) and for other training environments including a live environment. It also examined migrating CITT to operating systems and office suites

other than NT 4.0 and Office 97. The TSP approval and dissemination requirements for this option were provided that essentially mirrored those for the near-term solution.

The long-term implementation option examined the full integration of CITT into the ATIA. It would primarily become a software segment of the training development AIS, although some functions might be part of design, analysis, or evaluation AIS. Requirements for data storage and retrieval, TSP components definition, exercise assessment, and exercise dissemination that would fit within ATIA were discussed.

Based on the work completed during the project, the following recommendations are made:

- Extensive user testing of CEIT as a stand-alone application and of CEIT running within the CITT needs to be completed.
- A systematic test of the ability of the exercise initialization file produced by CITT to actually initialize an exercise at the CCTT site needs to be conducted. Similarly, the ability to import into CITT an exercise initialization file produced by CCTT also needs to be conducted.
- The Army should consider upgrading users' personal computer systems not only because the typical user system will not support CITT, but because it will undoubtedly also not support other future training systems.
- Further development of CITT and CEIT needs to occur to provide versions that will run on other systems widely used in the Army or systems that will be widely used in the future. This should specifically examine developing CITT/CEIT to run under Windows 98, Windows 2000, and Windows XP as well as Office 2000 and Office XP. To be of value to the greatest number of users, CITT/CEIT should be able to work on their systems rather than requiring them to go to different hardware and software.
- The Army needs to fully examine the implications of exercise approval and dissemination on units' ability to develop collective training using existing training as a starting point. Decisions need to be made regarding who approves exercises and whether approval varies depending upon what an exercise will be used for. Other decisions need to be made regarding how exercises will be shared among units.
- Related to the previous recommendation, the Army needs to examine issues related to units sharing exercises they have developed primarily in terms of providing incentives to do so. Absent such incentives, it is quite possible that exercises will be shared only sporadically resulting in much duplication of effort.
- During near-term implementation, a change control process to support any required modifications to CITT/CEIT needs to be established. The current user support mechanisms also need to be maintained.

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Appendix A

Acronym List

AAR	After action review
ACCC	Armor Captains Career Course
AFRU	Armored Forces Research Unit
AIS	Automated Information Systems
ARI	U.S. Army Research Institute for the Behavioral and Social Sciences
ASAT	Automated Systems Approach to Training
ATC	Army Training Center
ATIA	Army Training Information Architecture
ATSC	Army Training Support Center
AVCATT	Aviation Combined Arms Tactical Trainer
CATT	Combined Arms Tactical Trainer
CCTT	Close Combat Tactical Trainer
CEIT	CCTT Exercise Initialization Tool
CITT	Commanders' Integrated Training Tool
COR	contracting officer's representative
CS	combat support
CSS	combat service support
DA	Department of the Army
DIM	Dismounted Infantry Module
DTDD	Directorate of Training and Doctrine Development
FABTOC	field artillery battalion tactical operations center
FBCB2	Force XXI Battle Command Brigade and Below
FDC	fire direction center
FE	formative evaluation
FSCATTT	Fire Support Combined Arms Tactical Trainer
FSE	fire support element
GB	giga-byte
GUI	graphical user interface
IDEF	Integrated Definition
ISD	Instructional Systems Design
ITMC	Institutional Training Management Configuration
MAJ	major
MB	megabyte
MHz	megahertz
MTP	Mission Training Plan

NTC	National Training Center
OC	Operations Center
OC/SAF	Operations Center/Semi-Automated Forces
P1	Primary 1
P2	Primary 2
P3	Primary 3
PDSS	Post Deployment Software Support
PE	practical exercise
PM	project manager
POC	point of contact
PM CATT	Project Manager for the Combined Arms Tactical Trainer
RAM	random-access memory
R&D	research and development
RDL	Reimer Digital Library
SAF	Semi-Automated Forces
SAM	Commanders' Integrated Training Tool for the Close Combat Tactical Trainer System Administrator's Manual
SASO	stability and support operations
SAT	Systems Approach to Training
SATS	Standard Army Training System
SME	subject matter expert
SOSO	stability operations, support operations
SOW	statement of work
SR-UAV	short-range unmanned aerial vehicle
STRUCCTT	Structured Training for Units in the Close Combat Tactical Trainer
TDB	terrain database
TRADOC	U.S. Army Training and Doctrine Command
TSM	TRADOC System Manager
TSP	training support package
T-UAV	tactical unmanned aerial vehicle
UAV	unmanned aerial vehicle
UMW	University of Mounted Warfare
UTMC	Unit Training Management Configuration
VLET	Virtual Leader Effects Trainer
WWW	world wide web

Appendix B

Stability and Support Operations References

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Appendix C

Close Combat Tactical Trainer Enhancements for Stability Operations

Civilian Vehicle Models

<i>Variants</i>	Buses
	Commercial Trucks
	Tanker Truck
	Cargo Truck
	Flatbed Truck
	Cattle Truck
	Pickup trucks
	Cars
	Tractors/Agricultural vehicles
	Construction Equipment
	Bicycles
	Animal drawn carts/wagons
	VIP Vehicles
	Ambulances (markings could be designated as either red cross or red crescent)
	Fire Trucks
	Helicopters
	Airplanes
	“Technical” vehicle (along the lines of those seen in Somalia)

Civilian Personnel Models – The various types could be replicated by clothing and skin tones.

<i>Variants</i>	4-person family (man, woman, children x 2)
	Mother and child
	Elderly people
	Policeman
	Fireman
	Merchants
	Religious leader
	Local government official
<i>Types</i>	Eastern European
	Middle Eastern
	African
	Asian
	Central/South American
	<i>Status</i>
	Healthy
	Wounded
	Dead

Irregular Forces Models – These would be based on a nine person organization and would have the following parameters. Personnel would be wearing civilian clothing. Personnel would be dismounted and have no vehicles, but could be assigned to one of the civilian vehicle models.

<i>Types</i>	Eastern European	<i>Armed</i>	U.S. weapons	<i>Unarmed</i>
	Middle Eastern		Former Soviet weapons	
	African		World War II era weapons	
	Asian			
	South American			

Instructions Execute Movement
 Conduct Direct Fire Engagement

Unexploded Ordnance (Relocatable) – This would be a relocatable object similar to conventional minefields. They would appear on the surface of the terrain.

<i>Parameters</i>	Dimensions	Munition Type	Density
	Timed/Untimed		

Dismounted Infantry Units – These would consist of nine soldier organizations that are purely dismounted, no organic vehicles. Uniforms, equipment, and weapons would be based on the appropriate nationality.

<i>Nationality</i>	United States	Great Britain	Canada
	Germany	France	Russia
	Italy		

Instructions Execute Movement
 Conduct Direct Fire Engagement
 Operate Observation Post
 Operate Checkpoint
 Conduct Dismounted Patrol

Sniper Teams (Irregular Forces) – These would be two person teams, sniper and observer. Personnel would be wearing civilian clothing.

<i>Types</i>	Eastern European	<i>Weapons</i>	<i>Sniper</i>	<i>Observer</i>
	Middle Eastern		SVD	AK-74
	African		M24	M16A1
	Asian			
	Central/South American			

Instructions Conduct Tactical Movement
 Occupy Sniper Position
 Execute Sniper Engagement

Civilian Crowd Models – These would be models of civilian crowds with the following parameters. The nature of the crowd could be determined by way the crowd acts; if they are shaking their fists or carrying protest signs they would appear hostile. Crowds could also be used to replicate displaced civilians or refugees.

Size	25 people	Types	Eastern European	Gender Ratio	All male
	50 people		Middle Eastern		50 M/50 F
	75 people		African		75 M/25 F
			Asian		25 M/75 F
			Central/South American		All female
Nature	Friendly				
	Neutral				
	Hostile				

Relocatable Objects

<i>Types</i>	Tents
	Light stands
	Radio antennas
	Checkpoints
	Deliberate observations post
	Guard/observation towers
	Booby traps (this would also entail being able to include bombs on the civilian vehicles)
	Blockades made from debris

Convoy Models – For each group of 10 vehicles there should be at least one light wheeled vehicle to replicate the convoy commander's vehicle.

<i>Types</i>	U.S. Military vehicles	<i># of vehicles</i>	10
	Foreign Military vehicles		20
	Civilian vehicles		30
	UN Vehicles		

Instructions Execute Convoy Movement

Increased Fidelity for Urban Areas – In order to replicate an urban setting likely to be encountered during stability operations greater fidelity should be created. This does not necessarily need to be applied to an entire terrain database but could be limited to one or two urban areas on a terrain database.

Categories Villages (size based on a population of 3,000 or less)
 Strip areas (industrialized zones built along roads connecting towns or cities)
 Towns (size based on population of up to 100,000 and not part of a major urban complex)
 Cities (population up to 1,000,000 with large urban complex)

Damage – Much like vehicles can be set to mobility, firepower, etc., urban areas should have damage settings. Damage could be randomly induced on buildings, bridges, roads, etc.

Streets – Rather than having a few major streets in urban areas, have as many streets as possible.

Buildings – Ideally you would want buildings to have fidelity that would allow for people using the dismounted infantry module to actually enter the building. Again, this doesn't have to be every building on the terrain database but could be limited to one or two buildings. Ideally the buildings would resemble those found in the regions that are used for the civilian and irregular forces (i.e., Eastern European, Middle Eastern, African, etc.).

Types Residential
 Merchant stores
 Commercial buildings
 Government buildings
 Hospitals
 Police Stations
 Fire Stations
 Radio/Television
 Shopping centers
 Food distribution centers
 Religious buildings (churches, mosques, temples, etc.)

Patterns of Activity – Patterns of activity would be the normal routine occurrences one would see in an urban setting. For example in the morning people are going to work and there is an increase in traffic and activity. Conversely late at night there is very little activity occurring because most people are home asleep. Also, you would expect to see doors and windows open during business hours, you would expect lights to come on at night. It may be possible to define a set pattern of activity based on the size of the urban area and it could be tied to the exercise time to reflect the daily pattern of life. This affects stability operations because sometimes a significant change in normal patterns of activity can indicate that something is about to occur or has occurred.

Unmanned Aerial Vehicle (UAV) Models – This may already be in the works. The CCTT should provide UAVs. The images from the UAV could be sent to the "out the window" display

in the after action review (AAR) room. This would allow the commander access to the imagery. The UAVs would be useful in conventional combat scenarios also. They are also one of the assets the surveillance troop in the Reconnaissance, Surveillance, and Target Acquisition Squadron is supposed to have.

<i>Types</i>	Outrider (tactical UAV [T-UAV])
	Pioneer (short-range UAV [SR-UAV])

News Media Model – This could be comprised of a vehicle and two news people. If possible you would want the model to actually be able to record events that happen during an exercise and be able to play them back during an AAR.

Model Interaction – Currently in the Close Combat Tactical Trainer (CCTT) the models are programmed to react to one another in a specific way. For example an opposing forces Semi-Automated Forces tank platoon will automatically begin to execute actions on contact when it identifies a blue forces unit unless its situational interrupts are turned off or they are set to “Hold Fire.” Essentially everything is either friendly or enemy and reacts accordingly. For stability operations this would probably not be the best approach. From a training units perspective everything would essentially be unknown or neutral until it demonstrates a clear, hostile intent. In an actual stability operations deployment, the difference between a noncombatant civilian and a civilian who is a rebel or terrorist could be very hard to distinguish until they commit a hostile act. This would need to be attended to in CCTT.

Graphic Control Measures – Update CCTT to include the appropriate stability and support operations symbology from Appendix D, Field Manual 101-5-1 Operational Terms and Graphics (DA, 1997).

Use some type of virtual reality goggles to increase situational awareness of leaders and soldiers.